

### REMARKS

Claims 1-4 are pending in this application, of which claims 1, 2 and 4 are independent. Independent claims 1, 2 and 4 have been amended. No new matter has been added by way of this amendment. Favorable reconsideration and further examination is respectfully requested in view of the foregoing amendments and the following comments of the Applicants, which are preceded by related comments of the Examiner in small bold type:

#### *Information Disclosure Statement*

**2. Cover pages for an Information Disclosure Statement (IDS) dated July 3, 2006 were received, but apparently no IDS was attached for scanning into the electronic files. The paper files were searched to confirm that no IDS was available. The Applicant is requested to kindly resubmit the IDS.**

Applicants believe that a supplemental IDS was inadvertently filed on 29 June 2006 without a 1449 form (referred to by the Examiner as the IDS dated July 3, 2006). To correct the matter, another supplemental IDS was filed on 30 June 2006 that contained a proper 1449 form. A copy of this 1449 form filed on 30 June 2006 (along with the references and transmittal forms) is provided with this response.

#### *Claim Objections*

**Claim 2 is objected to because of the following informalities: While the specification discloses a method of simulating the advection of elements through space, the preamble appears to claim a method of actually moving a physical element through space.  
Appropriate correction is required.**

Claim 2 has been amended. In particular, the preamble of the claim has been amended to read "simulating elements advecting through space".

#### *Claim Rejections - 35 USC §101*

**Claims 1-4 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.**

**a. Regarding claim 1, the claim does not appear to produce a useful and tangible result to form the basis of a practical application**

needed to be statutory. Simulating advecting elements through 3D space does not appear to be a tangible result.

b. Regarding claims 2-3, the claims do not appear to produce a useful and tangible result to form the basis of a practical application needed to be statutory. Determining element movement information does not appear to be a tangible result.

c. Regarding claim 4, the claim does not appear to produce a useful and tangible result to form the basis of a practical application needed to be statutory. Simulating advecting elements through 3D space does not appear to be a tangible result. Please note that an apparatus that does not produce a useful and tangible result is rejected under 35 USC § 101.

d. Regarding claim 4, the claim appears to be directed to an arrangement of software being claimed as a set of functional descriptive material per se, and as such, is non-statutory. While the preamble recites an apparatus, the "means for" limitations do not appear to include any means for processing, rather the limitations all appear to be software per se.

Applicants have amended independent claims 1, 2 and 4. Regarding claim 1, the claim has been amended such that the elements advecting through 3D space are simulated for rendering by a computing device. Independent claim 2 has been amended in a similar manner. As such, Applicants assert that amended independent method claims 1 and 2 are directed to statutory subject matter. Claim 3 depends upon amended independent claim 2 and is directed to statutory subject matter. Regarding independent claim 4, the claim has been amended so that the apparatus includes a computing device capable of performing operations for simulating elements advecting through a region of 3D space using movement information associated with 2D grids. As such, Applicants assert that amended independent claim 4 is directed to statutory subject matter.

#### *Claim Rejections - 35 USC §102*

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Fedkiw (Ronaki Fedkiw et al.; "Visual simulation of smoke", 2001, Proceedings of SIGGRAPH 2001, art provided by the Applicant on the IDS dated October 29, 2003).

Amended independent claim 1 defines a method of simulating movement of elements through space. The method includes generating 2D grids in which each 2D grid has a plurality of grid points. The method also includes associating movement information with each 2D grid point and changing the movement information associated with the 2D grid points over a period of time. The method also includes defining a region of 3D space using the 2D grids and advecting the elements through the region of 3D space using the movement information associated with the 2D grids for display on a computing device.

The applied art is not understood to disclose or to suggest features of amended independent claim 1. In particular, the art is not understood to disclose or suggest simulating the advecting of elements through a region of 3D space using movement information associated with the 2D grids.

Fedkiw describes a three-dimensional numerical computation method for smoke simulation for computer graphic applications. By adapting techniques from computation fluid dynamics (CFD), a model is proposed that provides stable and rapid animation of gases (such as smoke) that doesn't suffer from excessive numerical dissipation. However, Fedkiw uses three dimensional computations to solve fluid flow equations and generate simulation data. In this regard, citing from the start of section "4 Implementation" of Fedkiw:

"We use a finite volume spatial discretization to numerically solve the equations of fluid flow. As shown in Figure 1, we dice up the computational domain into voxels. The temperature, the smoke's density and the external forces are defined at the center of each voxel while the velocity is defined on the appropriate voxel faces (see Figure 1, right). Notice that this arrangement is identical to that of Foster and Mextas [6] but differs from one used by Siam [17] where the velocity was defined at the voxel centers as well. Our staggered grid arrangement of the velocity field gives improved results for numerical methods with less article dissipation. See appendix A for more details on our discretization." (Page 17, first column, last paragraph to top of second column)

Further, citing from the start of appendix "A Discretization" of Fedkiw:

"We assume a uniform discretization of space into  $N^3$  voxels with uniform spacing  $h$ , the temperature and the smoke's density are both defined at the voxel centers and denoted by

$$T_{i,j,k} \quad \text{and} \quad \rho_{i,j,k} \quad i,j,k = 1, \dots, N,"$$

Thus, Fedkiw describes numerically solving three dimensional fluid flow equations for discrete voxels (i.e., a three dimensional unit of volume) included in a three dimensional space and generating three dimensional simulation data. In contrast, Applicants' describe associating movement information with two dimensional grid points. The two dimensional movement information is used to simulate elements advecting through a three dimensional space that is defined using the two dimensional grids.

Accordingly, Fedkiw fails at least to disclose or to suggest advecting elements through a region of 3D space using movement information associated with the 2D grids.

Amended independent claim 4 is an apparatus claim that corresponds to subject matter of amended independent claim 1. This claim is also believed to be allowable for at least the reasons noted above.

***Claim Rejections - 35 USC § 103***

**Claims 2 - 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fedkiw (Ronald Fedkiw et al.; "Visual simulation of smoke", 2001, Proceedings of SIGGRAPH 2001, art provided by the Applicant on the IDS dated October 29, 2003) in view of Wyvill (Brian Wyvill et al.; "Animating soft objects", 1986, The Visual Computer, Volume 2, pages 235 - 242, art provided by the Applicant on the IDS dated November 21, 2003).**

Wyvill is not understood to remedy the deficiencies of Fedkiw. Wyvill provides a methodology for changing a soft object's shape as the object is animated (yet still appear natural) (see page 235, second column, first paragraph). As such, the reference is not understood to disclose or to suggest simulating the advecting of elements through a region of 3D space using movement information associated with 2D grids, as required by amended independent claim 2. Dependent claim 3 partakes of the novelty of amended independent parent claim 2, and, although

it is believed that the dependent claim defines a separate patentable feature, for this reason the dependent claim is not discussed here in detail.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

In view of the foregoing remarks, the entire application is now believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' attorney can be reached at the address shown below. Telephone calls regarding this application should be directed to 617-368-2191.

No fee is believed to be due for this Amendment; however, if any fees are due, please apply them to Deposit Account 06-1050, reference 20567-023001.

Respectfully submitted,

Date:

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Jeffrey J. Barclay  
Reg. No. 48,950

Fish & Richardson P.C.  
Telephone: (617) 542-5070  
Facsimile: (617) 542-8906